Manual
of test hammer

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Test Hammer is a traditional non-destructive test instrument that is used to determine the compressive strength or hardness of hardened concrete or rock. It provides a quick and easy in place test for obtaining an immediate indication。

One How to operate

During testing, keeping test hammer perpendicular to test surface. Operation procedures as follows:

Step 1. Generally, test hammer was locked during storage, we should unlock it before a test. Take out test hammer, keeping the rebound pole perpendicular to a surface (any hard). Pushing test hammer on end cover slowly, the hammer will unlock and the button will bound out, stop pushing, removing the test hammer away from the surface, rebound pole will reach out, and at the same time the rebound hammer will be hooked because of the pushing from compression spring, now it's ready for a test.

Step 2. Aim at test point, keep perpendicular, push slowly, rebound pole will be pushed into the test hammer, at the same time, the compressing spring get compressed, but the tension spring get stretch and uptight, keep pushing till rebound hammer unhook, the rebound hammer will impact rebound pole by the pulling from tension spring. After impact with rebound pole, the rebound hammer will be rebounded and take the pointer up; the pointer will stop at the highest position, and we can know the position by the gauge, each position against a value that is rebound value. Note that before you record the rebound value DO NOT loose your hand, or the pointer will ZERO SET automatically by the push from the compression spring.

Note: If it is difficult to see the reading under the conditions specified in Step 2, lock hammer by PRESS THE BUTTON ONLY AFTER IMPACT and remove the device to a convenient place in order to read the gauge. And unlock it by step 1 after

reading for another test.

Step 3. Continue test at other test points.

Step 4. End of the test, push the rebound pole back into the test hammer, just like above test procedure. After the rebound hammer impact, press the button and the test hammer will be lock. Then clear it and put back suitcase.

Remarks:

A. When performing tests on non-vertical surfaces, and hence not holding the instrument horizontally; it is essential to take into account the factor of gravity acting upon the impact shock, and the carbonation depth is another factor need taken into if necessary, a precise conversion sheet has be provided by manufacturer.

B. Please note that careful operation is helpful to accuracy, and keep the instrument from fall, water, drop, collision and other damage.

C. Test must be performed on smooth and uniform surface obtained from castings. Avoid uneven and porous surfaces, lumps of gravel and joints in the concrete. Tests on thin sections or zones less 10 cm, wide require particular care in the interpretation of the results, because of the distortion due to the elasticity of the section. If possible, the back of the section should be held stiff by some means.

D. It is advisable to take more than 12 readings in order to obtain a reliable average value Rm. Interval between each test points should be 2 or 3 cm.

Note: The compressive strength Mpa against the Rm(average rebound values) please refer to the chapter seven.

Two Calibrate Test hammer

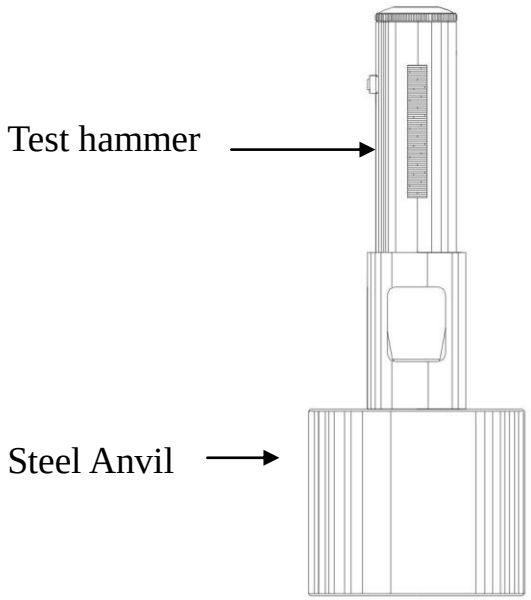
Every instrument needs calibration or adjustment after long time use.

According to the standard regulation, we can calibrate test hammer by a standard calibration steel anvil. The calibration steel anvil for the test hammer must with hardness of HRC58~62.

Calibration is simple but important and indispensable.

Calibration circumstance: dry and room temperature 5~35℃

Procedure: Calibrating test hammer just like a test, but the analyte is the steel anvil. Operation test hammer on steel anvil, and inspect the rebound value, a qualified test hammer can get a value of Rm=80±2. Calibration values are differ according to differ test hammers.



If you need steel anvil, please contact with us.

Three Rectification of test hammer

The device does not require special maintenance. Avoid letting dust collect in the rebound pole and penetrating inside the device. Also, BEWARE of the rebound pole and hammer becoming dirty from oil or dust from the contact surface, as this could create errors in the rebound impact.

In order to keep reliability and good accuracy of test hammer, we should rectify the hammer generally and periodically.

After the test hammer HT-225 was operated each 2000 times or doubt the accuracy of test data, we should calibrate it on steel anvil model GZ16. But, only by steel anvil to judge that the test hammer be in standard status is not enough, following inspections are recommended for double confirmation.

1. Testing the max static friction between pointer slider and shaft in the instrument, it should be fall in the scope of 0.5-0.8N. Or adjust the slider till meet the request.

2. Check the effective work length of the tension spring see if it is 61.5mm, usually by adjusting the hole that the spring set in can get the suitable length.

3. Check the stroke distance of strike hammer (rebound hammer). That is means the spring will stretch up to 75 mm. 75mm should be the length under work status the spring being stretched to longest, but it’s difficult for us to check the length in the test hammer. However, we can indirectly check the length by following method:

Taking out the machine core, hook the strike hammer on the hook, hanging-up, pulling the tension spring by spring base till the strike side of rebound pole appears. Measuring the distance between two strike sides, if the length in the scope of 76.1mm~75.7mm, it's OK, or need adjust.

Why the length isn't 75mm in the method? That is because we should consider a rectify value from the compression of buffer spring.

4. At the end of rectification, we need calibrate the test hammer on the steel anvil, the test value should be Rm=80±2.

Generally, before above procedures, we should clear the machine core by petrol or alcohol. The center pole should be wiped with little watch oil.

Four Maintenance

In order to keep good accuracy, we should be careful in operation and storage. Daily maintenance is strong recommended.

1. Before put test hammer back to the suitcase after each test work, we should clear it; too much dirt will influence accuracy even make the instrument out of work.

2. Do not play test hammer for fun, or test unclear metal object.

3. Generally, clear the machine core is definitely good after long time use or after used in dirty place. Clear it by petrol or alcohol, and wipe watch oil on center pole, at the end, calibrate it on the steel anvil. During a large number of tests, we should keep regular maintenance.

Five Detach and assemble

Making test hammer against hard place, push end cover till the button loose, stop pushing and let rebound pole reach out of the device slowly.

Screw off end cover and take out the compression spring, screw off the cover cap, detach the semicircular clasp.

Keep the device upright (the rebound pole downwards), move the core component to tail, hold the hook and unhook the rebound hammer, take out the core component. Note it must be unhook firstly when you take it out or set it back.

Detach the core component, impact rebound pole lightly by rebound hammer, rebound pole will leave from the center rod, don't miss the buffer spring. In general situation, the three components, rebound hammer, tension spring and spring base shouldn't be detached, in case the tension spring transformation.

Screw pointer pole by opener from the end of the instrument, the pointer pole will separate from a front fixer, keeping screwing till pointer pole separate from pointer slider.

Generally, we don't have to detach the gauge..

Above are detach procedures, assembling procedures are opposite against above. Of course calibration on steel anvil is indispensable at the end of all rectification and assembling, test values should be Rm=80±2.

Six Reference information

Technical specifications

Measuring ranges: 10-60MPa

Impact energy: 2.207±0.1J（0.225Kgf.m)

Length of spring stretch: 75±0.3mm

The static friction of pointer slider: 0.65N~0.15N

Radius of spherical tip : 25mm±1mm

The average rebound values on steel anvil: 80±2

Housing dimensions: Φ54*280mm

Weight: ≈1Kg

Submit to industry-standard “JGJ/T23-2001 <Technical Specification for Inspection of Concrete Compressive Strength by Rebound Method> Summary.

1. Test surface
2. Rebound pole
3. Dust felt ring
4. Semicircular clasp
5. Tension spring
6. Body B
7. Fixer 1
8. Scale
9. Pointer axis
10. Center rod
11. Shrapnel
12. Pointer slider
13. Guide flange
14. Hook spring
15. Fixer 2
16. End cover
17. Compression spring
18. Tighten nut
19. Adjust bolt
20. Hook
21. Master lock
22. Position lock hook
23. Button nut
24. Button block
25. Button spring
26. Shell
27. Rebound hammer (impact hammer)
28. Spring circle
29. buffer spring
30. Spring block
31. Cover cap

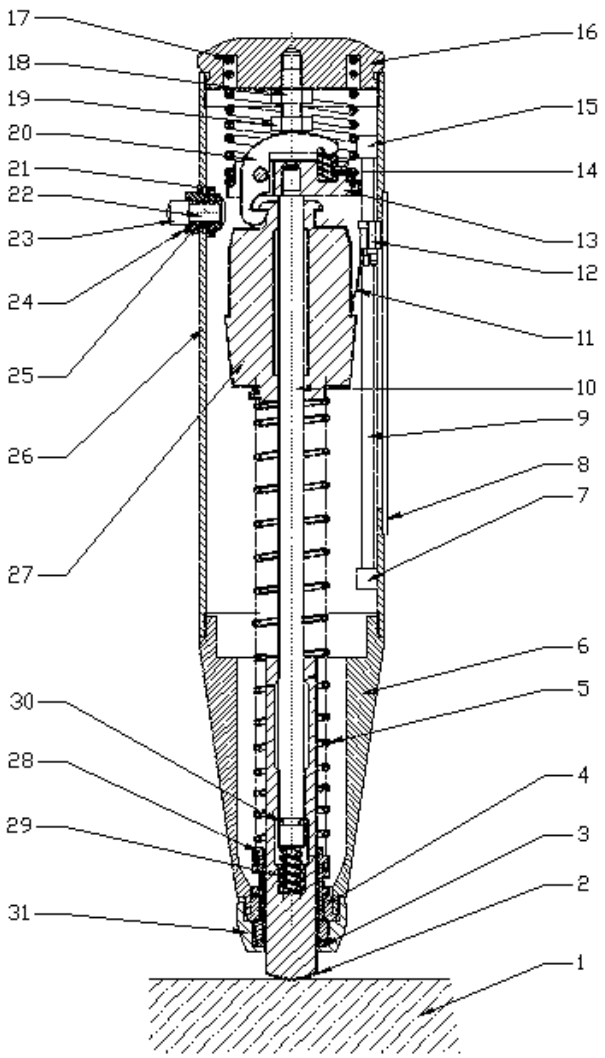


Figure 1 Structure of Test Hammer HT225

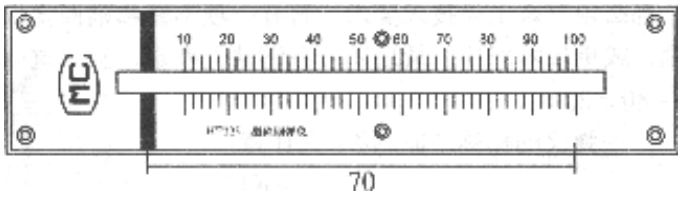


Figure 2 Gauge

Seven Compressive strength (Mpa) / Rm

Rm	**Compressive strength (Mpa)**												
	Carbonation depth (mm)												
	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	⩾6.0
20	10.3	10.1	—	—	—	—	—	—	—	—	—	—	—
20.2	10.5	10.3	10	—	—	—	—	—	—	—	—	—	—
20.4	10.7	10.5	10.2	—	—	—	—	—	—	—	—	—	—
20.6	11	10.8	10.4	10.1	—	—	—	—	—	—	—	—	—
20.8	11.2	11	10.6	10.3	—	—	—	—	—	—	—	—	—
21	11.4	11.2	10.8	10.5	10	—	—	—	—	—	—	—	—
21.2	11.6	11.4	11	10.7	10.2	—	—	—	—	—	—	—	—
21.4	11.8	11.6	11.2	10.9	10.4	10	—	—	—	—	—	—	—
21.6	12	11.8	11.4	11	10.6	10.2	—	—	—	—	—	—	—
21.8	12.3	12.1	11.7	11.3	10.8	10.5	10.1	—	—	—	—	—	—
22	12.5	12.2	11.9	11.5	11	10.6	10.2	—	—	—	—	—	—
22.2	12.7	12.4	12.1	11.7	11.2	10.8	10.4	10	—	—	—	—	—
22.4	13	12.7	12.4	12	11.4	11	10.7	10.3	10	—	—	—	—
22.6	13.2	12.9	12.5	12.1	11.6	11.2	10.8	10.4	10.2	—	—	—	—
22.8	13.4	13.1	12.7	12.3	11.8	11.4	11	10.6	10.3	—	—	—	—
23	13.7	13.4	13	12.6	12.1	11.6	11.2	10.8	10.5	10.1	—	—	—
23.2	13.9	13.6	13.2	12.8	12.2	11.8	11.4	11	10.7	10.3	10	—	—
23.4	14.1	13.8	13.4	13	12.4	12	11.6	11.2	10.9	10.4	10.2	—	—
23.6	14.4	14.1	13.7	13.2	12.7	12.2	11.8	11.4	11.1	10.7	10.4	10.1	—
23.8	14.6	14.3	13.9	13.4	12.8	12.4	12	11.5	11.2	10.8	10.5	10.2	—
24	14.9	14.6	14.2	13.7	13.1	12.7	12.2	11.8	11.5	11	10.7	10.4	10.1
24.2	15.1	14.8	14.3	13.9	13.3	12.8	12.4	11.9	11.6	11.2	10.9	10.6	10.3
24.4	15.4	15.1	14.6	14.2	13.6	13.1	12.6	12.2	11.9	11.4	11.1	10.8	10.4
24.6	15.6	15.3	14.8	14.4	13.7	13.3	12.8	12.3	12	11.5	11.2	10.9	10.6
24.8	15.9	15.6	15.1	14.6	14	13.5	13	12.6	12.2	11.8	11.4	11.1	10.7
25	16.2	15.9	15.4	14.9	14.3	13.8	13.3	12.8	12.5	12	11.7	11.3	10.9
25.2	16.4	16.1	15.6	15.1	14.4	13.9	13.4	13	12.6	12.1	11.8	11.5	11
25.4	16.7	16.4	15.9	15.4	14.7	14.2	13.7	13.2	12.9	12.4	12	11.7	11.2
25.6	16.9	16.6	16.1	15.7	14.9	14.4	13.9	13.4	13	12.5	12.2	11.8	11.3

Rm	**Compressive strength (Mpa)**												
	Carbonation depth (mm)												
	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	⩾6.0
25.8	17.2	16.9	16.3	15.8	15.1	14.6	14.1	13.6	13.2	12.7	12.4	12	11.5
26	17.5	17.2	16.6	16.1	15.4	14.9	14.4	13.8	13.5	13	12.6	12.2	11.6
26.2	17.8	17.4	16.9	16.4	15.7	15.1	14.6	14	13.7	13.2	12.8	12.4	11.8
26.4	18	17.6	17.1	16.6	15.8	15.3	14.8	14.2	13.9	13.3	13	12.6	12
26.6	18.3	17.9	17.4	16.8	16.1	15.6	15	14.4	14.1	13.5	13.2	12.8	12.1
26.8	18.6	18.2	17.7	17.1	16.4	15.8	15.3	14.6	14.3	13.8	13.4	12.9	12.3
27	18.9	18.5	18	17.4	16.6	16.1	15.5	14.8	14.6	14	13.6	13.1	12.4
27.2	19.1	18.7	18.1	17.6	16.8	16.2	15.7	15	14.7	14.1	13.8	13.3	12.6
27.4	19.4	19	18.4	17.8	17	16.4	15.9	15.2	14.9	14.3	14	13.4	12.7
27.6	19.7	19.3	18.7	18	17.2	16.6	16.1	15.4	15.1	14.5	14.1	13.6	12.9
27.8	20	19.6	19	18.2	17.4	16.8	16.3	15.6	15.3	14.7	14.2	13.7	13
28	20.3	19.7	19.2	18.4	17.6	17	16.5	15.8	15.4	14.8	14.4	13.9	13.2
28.2	20.6	20	19.5	18.6	17.8	17.2	16.7	16	15.6	15	14.6	14	13.3
28.4	20.9	20.3	19.7	18.8	18	17.4	16.9	16.2	15.8	15.2	14.8	14.2	13.5
28.6	21.2	20.6	20	19.1	18.2	17.6	17.1	16.4	16	15.4	15	14.3	13.6
28.8	21.5	20.9	20.2	19.4	18.5	17.8	17.3	16.6	16.2	15.6	15.2	14.5	13.8
29	21.8	21.1	20.5	19.6	18.7	18.1	17.5	16.8	16.4	15.8	15.4	14.6	13.9
29.2	22.1	21.4	20.8	19.9	19	18.3	17.7	17	16.6	16	15.6	14.8	14.1
29.4	22.4	21.7	21.1	20.2	19.3	18.6	17.9	17.2	16.8	16.2	15.8	15	14.2
29.6	22.7	22	21.3	20.4	19.5	18.8	18.2	17.5	17	16.4	16	15.1	14.4
29.8	23	22.3	21.6	20.7	19.8	19.1	18.4	17.7	17.2	16.6	16.2	15.3	14.5
30	23.3	22.6	21.9	21	20	19.3	18.6	17.9	17.4	16.8	16.4	15.4	14.7
30.2	23.6	22.9	22.2	21.2	20.3	19.6	18.9	18.2	17.6	17	16.6	15.6	14.9
30.4	23.9	23.2	22.5	21.5	20.6	19.8	19.1	18.4	17.8	17.2	16.8	15.8	15.1
30.6	24.3	23.6	22.8	21.9	20.9	20.2	19.4	18.7	18	17.5	17	16	15.2
30.8	24.6	23.9	23.1	22.1	21.2	20.4	19.7	18.9	18.2	17.7	17.2	16.2	15.4
31	24.9	24.2	23.4	22.4	21.4	20.7	19.9	19.2	18.4	17.9	17.4	16.4	15.5
31.2	25.2	24.4	23.7	22.7	21.7	20.9	20.2	19.4	18.6	18.1	17.6	16.6	15.7
31.4	25.6	24.8	24.1	23	22	21.2	20.5	19.7	18.9	18.4	17.8	16.9	15.8
31.6	25.9	25.1	24.3	23.3	22.3	21.5	20.7	19.9	19.2	18.6	18	17.1	16
31.8	26.2	25.4	24.6	23.6	22.5	21.7	21	20.2	19.4	18.9	18.2	17.3	16.2
32	26.5	25.7	24.9	23.9	22.8	22	21.2	20.4	19.6	19.1	18.4	17.5	16.4
32.2	26.9	26.1	25.3	24.2	23.1	22.3	21.5	20.7	19.9	19.4	18.6	17.7	16.6
32.4	27.2	26.4	25.6	24.5	23.4	22.6	21.8	20.9	20.1	19.6	18.8	17.9	16.8
32.6	27.6	26.8	25.9	24.8	23.7	22.9	22.1	21.3	20.4	19.9	19	18.1	17

Rm	**Compressive strength (Mpa)**												
	Carbonation depth (mm)												
	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	⩾6.0
32.8	27.9	27.1	26.2	25.1	24	23.2	22.3	21.5	20.6	20.1	19.2	18.3	17.2
33	28.2	27.4	26.5	25.4	24.3	23.4	22.6	21.7	20.9	20.3	19.4	18.5	17.4
33.2	28.6	27.7	26.8	25.7	24.6	23.7	22.9	22	21.2	20.5	19.6	18.7	17.6
33.4	28.9	28	27.1	26	24.9	24	23.1	22.3	21.4	20.7	19.8	18.9	17.8
33.6	29.3	28.4	27.4	26.4	25.2	24.2	23.3	22.6	21.7	20.9	20	19.1	18
33.8	29.6	28.7	27.7	26.6	25.4	24.4	23.5	22.8	21.9	21.1	20.2	19.3	18.2
34	30	29.1	28	26.8	25.6	24.6	23.7	23	22.1	21.3	20.4	19.5	18.3
34.2	30.3	29.4	28.3	27	25.8	24.8	23.9	23.2	22.3	21.5	20.6	19.7	18.4
34.4	30.7	29.8	28.6	27.2	26	25	24.1	23.4	22.5	21.7	20.8	19.8	18.6
34.6	31.1	30.2	28.9	27.4	26.2	25.2	24.3	23.6	22.7	21.9	21	20	18.8
34.8	31.4	30.5	29.2	27.6	26.4	25.4	24.5	23.8	22.9	22.1	21.2	20.2	19
35	31.8	30.8	29.6	28	26.7	25.8	24.8	24	23.2	22.3	21.4	20.4	19.2
35.2	32.1	31.1	29.9	28.2	27	26	25	24.2	23.4	22.5	21.6	20.6	19.4
35.4	32.5	31.5	30.2	28.6	27.3	26.3	25.4	24.4	23.7	22.8	21.8	20.8	19.6
35.6	32.9	31.9	30.6	29	27.6	26.6	25.7	24.7	24	23	22	21	19.8
35.8	33.3	32.3	31	29.3	28	27	26	25	24.3	23.3	22.2	21.2	20
36	33.6	32.6	31.2	29.6	28.2	27.2	26.2	25.2	24.5	23.5	22.4	21.4	20.2
36.2	34	33	31.6	29.9	28.6	27.5	26.5	25.5	24.8	23.8	22.6	21.6	20.4
36.4	34.4	33.4	32	30.3	28.9	27.9	26.8	25.8	25.1	24.1	22.8	21.8	20.6
36.6	34.8	33.8	32.4	30.6	29.2	28.2	27.1	26.1	25.4	24.4	23	22	20.9
36.8	35.2	34.1	32.7	31	29.6	28.5	27.5	26.4	25.7	24.6	23.2	22.2	21.1
37	35.5	34.4	33	31.2	29.8	28.8	27.7	26.6	25.9	24.8	23.4	22.4	21.3
37.2	35.9	34.8	33.4	31.6	30.2	29.1	28	26.9	26.2	25.1	23.7	22.6	21.5
37.4	36.3	35.2	33.8	31.9	30.5	29.4	28.3	27.2	26.5	25.4	24	22.9	21.8
37.6	36.7	35.6	34.1	32.3	30.8	29.7	28.6	27.5	26.8	25.7	24.2	23.1	22
37.8	37.1	36	34.5	32.6	31.2	30	28.9	27.8	27.1	26	24.5	23.4	22.3
38	37.5	36.4	34.9	33	31.5	30.3	29.2	28.1	27.4	26.2	24.8	23.6	22.5
38.2	37.9	36.8	35.2	33.4	31.8	30.6	29.5	28.4	27.7	26.5	25	23.9	22.7
38.4	38.3	37.2	35.6	33.7	32.1	30.9	29.8	28.7	28	26.8	25.3	24.1	23
38.6	38.7	37.5	36	34.1	32.4	31.2	30.1	29	28.3	27	25.5	24.4	23.2
38.8	39.1	37.9	36.4	34.4	32.7	31.5	30.4	29.3	28.5	27.2	25.8	24.6	23.5
39	39.5	38.2	36.7	34.7	33	31.8	30.6	29.6	28.8	27.4	26	24.8	23.7
39.2	39.9	38.5	37	35	33.3	32.1	30.8	29.8	29	27.6	26.2	25	24
39.4	40.3	38.8	37.3	35.3	33.6	32.4	31	30	29.2	27.8	26.4	25.2	24.2
39.6	40.7	39.1	37.6	35.6	33.9	32.7	31.2	30.2	29.4	28	26.6	25.4	24.4

Rm	**Compressive strength (Mpa)**												
	Carbonation depth (mm)												
	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	⩾6.0
39.8	41.2	39.6	38	35.9	34.2	33	31.4	30.5	29.7	28.2	26.8	25.6	24.7
40	41.6	39.9	38.3	36.2	34.5	33.3	31.7	30.8	30	28.4	27	25.8	25
40.2	42	40.3	38.6	36.5	34.8	33.6	32	31.1	30.2	28.6	27.3	26	25.2
40.4	42.4	40.7	39	36.9	35.1	33.9	32.3	31.4	30.5	28.8	27.6	26.2	25.4
40.6	42.8	41.1	39.4	37.2	35.4	34.2	32.6	31.7	30.8	29.1	27.8	26.5	25.7
40.8	43.3	41.6	39.8	37.7	35.7	34.5	32.9	32	31.2	29.4	28.1	26.8	26
41	43.7	42	40.2	38	36	34.8	33.2	32.3	31.5	29.7	28.4	27.1	26.2
41.2	44.1	42.3	40.6	38.4	36.3	35.1	33.5	32.6	31.8	30	28.7	27.3	26.5
41.4	44.5	42.7	40.9	38.7	36.6	35.4	33.8	32.9	32	30.3	28.9	27.6	26.7
41.6	45	43.2	41.4	39.2	36.9	35.7	34.2	33.3	32.4	30.6	29.2	27.9	27
41.8	45.4	43.6	41.8	39.5	37.2	36	34.5	33.6	32.7	30.9	29.5	28.1	27.2
42	45.9	44.1	42.2	39.9	37.6	36.3	34.9	34	33	31.2	29.8	28.5	27.5
42.2	46.3	44.4	42.6	40.3	38	36.6	35.2	34.3	33.3	31.5	30.1	28.7	27.8
42.4	46.7	44.8	43	40.6	38.3	36.9	35.5	34.6	33.6	31.8	30.4	29	28
42.6	47.2	45.3	43.4	41.1	38.7	37.3	35.9	34.9	34	32.1	30.7	29.3	28.3
42.8	47.6	45.7	43.8	41.4	39	37.6	36.2	35.2	34.3	32.4	30.9	29.5	28.6
43	48.1	46.2	44.2	41.8	39.4	38	36.6	35.6	34.6	32.7	31.3	29.8	28.9
43.2	48.5	46.6	44.6	42.2	39.8	38.3	36.9	35.9	34.9	33	31.5	30.1	29.1
43.4	49	47	45.1	42.6	40.2	38.7	37.2	36.3	35.3	33.3	31.8	30.4	29.4
43.6	49.4	47.4	45.4	43	40.5	39	37.5	36.6	35.6	33.6	32.1	30.6	29.6
43.8	49.9	47.9	45.9	43.4	40.9	39.4	37.9	36.9	35.9	33.9	32.4	30.9	29.9
44	50.4	48.4	46.4	43.8	41.3	39.8	38.3	37.3	36.3	34.3	32.8	31.2	30.2
44.2	50.8	48.8	46.7	44.2	41.7	40.1	38.6	37.6	36.6	34.5	33	31.5	30.5
44.4	51.3	49.2	47.2	44.6	42.1	40.5	39	38	36.9	34.9	33.3	31.8	30.8
44.6	51.7	49.6	47.6	45	42.4	40.8	39.3	38.3	37.2	35.2	33.6	32.1	31
44.8	52.2	50.1	48	45.4	42.8	41.2	39.7	38.6	37.6	35.5	33.9	32.4	31.3
45	52.7	50.6	48.5	45.8	43.2	41.6	40.1	39	37.9	35.8	34.3	32.7	31.6
45.2	53.2	51.1	48.9	46.3	43.6	42	40.4	39.4	38.3	36.2	34.6	33	31.9
45.4	53.6	51.5	49.4	46.6	44	42.3	40.7	39.7	38.6	36.4	34.8	33.2	32.2
45.6	54.1	51.9	49.8	47.1	44.4	42.7	41.1	40	39	36.8	35.2	33.5	32.5
45.8	54.6	52.4	50.2	47.5	44.8	43.1	41.5	40.4	39.3	37.1	35.5	33.9	32.8
46	55	52.8	50.6	47.9	45.2	43.5	41.9	40.8	39.7	37.5	35.8	34.2	33.1
46.2	55.5	53.3	51.1	48.3	45.5	43.8	42.2	41.1	40	37.7	36.1	34.4	33.3
46.4	56	53.8	51.5	48.7	45.9	44.2	42.6	41.4	40.3	38.1	36.4	34.7	33.6
46.6	56.5	54.2	52	49.2	46.3	44.6	42.9	41.8	40.7	38.4	36.7	35	33.9

Rm	**Compressive strength (Mpa)**												
	Carbonation depth (mm)												
	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	⩾6.0
46.8	57	54.7	52.4	49.6	46.7	45	43.3	42.2	41	38.8	37	35.3	34.2
47	57.5	55.2	52.9	50	47.2	45.2	43.7	42.6	41.4	39.1	37.4	35.6	34.5
47.2	58	55.7	53.4	50.5	47.6	45.8	44.1	42.9	41.8	39.4	37.7	36	34.8
47.4	58.5	56.2	53.8	50.9	48	46.2	44.5	43.3	42.1	39.8	38	36.3	35.1
47.6	59	56.6	54.3	51.3	48.4	46.6	44.8	43.7	42.5	40.1	38.4	36.6	35.4
47.8	59.5	57.1	54.7	51.8	48.8	47	45.2	44	42.8	40.5	38.7	36.9	35.7
48	60	57.6	55.2	52.2	49.2	47.4	45.6	44.4	43.2	40.8	39	37.2	36
48.2	—	58	55.7	52.6	49.6	47.8	46	44.8	43.6	41.1	39.3	37.5	36.3
48.4	—	58.6	56.1	53.1	50	48.2	46.4	45.1	43.9	41.5	39.6	37.8	36.6
48.6	—	59	56.6	53.5	50.4	48.6	46.7	45.5	44.3	41.8	40	38.1	36.9
48.8	—	59.5	57.1	54	50.9	49	47.1	45.9	44.6	42.2	40.3	38.4	37.2
49	—	60	57.5	54.4	51.3	49.4	47.5	46.2	45	42.5	40.6	38.8	37.5
49.2	—	—	58	54.8	51.7	49.8	47.9	46.6	45.4	42.8	41	39.1	37.8
49.4	—	—	58.5	55.3	52.1	50.2	48.3	47.1	45.8	43.2	41.3	39.4	38.2
49.6	—	—	58.9	55.7	52.5	50.6	48.7	47.4	46.2	43.6	41.7	39.7	38.5
49.8	—	—	59.4	56.2	53	51	49.1	47.8	46.5	43.9	42	40.1	38.8
50	—	—	59.9	56.7	53.4	51.4	49.5	48.2	46.9	44.3	42.3	40.4	39.1
50.2	—	—	—	57.1	53.8	51.9	49.9	48.5	47.2	44.6	42.6	40.7	39.4
50.4	—	—	—	57.6	54.3	52.3	50.3	49	47.7	45	43	41	39.7
50.6	—	—	—	58	54.7	52.7	50.7	49.4	48	45.4	43.4	41.4	40
50.8	—	—	—	58.5	55.1	53.1	51.1	49.8	48.4	45.7	43.7	41.7	40.3
51	—	—	—	59	55.6	53.5	51.5	50.1	48.8	46.1	44.1	42	40.7
51.2	—	—	—	59.4	56	54	51.9	50.5	49.2	46.4	44.4	42.3	41
51.4	—	—	—	59.9	56.4	54.4	52.3	50.9	49.6	46.8	44.7	42.7	41.3
51.6	—	—	—	—	56.9	54.8	52.7	51.3	50	47.2	45.1	43	41.6
51.8	—	—	—	—	57.3	55.2	53.1	51.7	50.3	47.5	45.4	43.3	41.8
52	—	—	—	—	57.8	55.7	53.6	52.1	50.7	47.9	45.8	43.7	42.3
52.2	—	—	—	—	58.2	56.1	54	52.5	51.1	48.3	46.2	44	42.6
52.4	—	—	—	—	58.7	56.5	54.4	53	51.5	48.7	46.5	44.4	43
52.6	—	—	—	—	59.1	57	54.8	53.4	51.9	49	46.9	44.7	43.3
52.8	—	—	—	—	59.6	57.4	55.2	53.8	52.3	49.4	47.3	45.1	43.6
53	—	—	—	—	60	57.8	55.6	54.2	52.7	49.8	47.6	45.4	43.9
53.2	—	—	—	—	—	58.3	56.1	54.6	53.1	50.2	48	45.8	44.3
53.4	—	—	—	—	—	58.7	56.5	55	53.5	50.5	48.3	46.1	44.6
53.6	—	—	—	—	—	59.2	56.9	55.4	53.9	50.9	48.7	46.4	44.9

Rm	**Compressive strength (Mpa)**												
	Carbonation depth (mm)												
	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	⩾6.0
53.8	—	—	—	—	—	59.6	57.3	55.8	54.3	51.3	49	46.8	45.3
54	—	—	—	—	—	—	57.8	56.3	54.7	51.7	49.4	47.1	45.6
54.2	—	—	—	—	—	—	58.2	56.7	55.1	52.1	49.8	47.5	46
54.4	—	—	—	—	—	—	58.6	57.1	55.6	52.5	50.2	47.9	46.3
54.6	—	—	—	—	—	—	59.1	57.5	56	52.9	50.5	48.2	46.6
54.8	—	—	—	—	—	—	59.5	57.9	56.4	53.2	50.9	48.5	47
55	—	—	—	—	—	—	59.9	58.4	56.8	53.6	51.3	48.9	47.3
55.2	—	—	—	—	—	—	—	58.8	57.2	54	51.6	49.3	47.7
55.4	—	—	—	—	—	—	—	59.2	57.6	54.4	52	49.6	48
55.6	—	—	—	—	—	—	—	59.7	58	54.8	52.4	50	48.4
55.8	—	—	—	—	—	—	—	—	58.5	55.2	52.8	50.3	48.7
56	—	—	—	—	—	—	—	—	58.9	55.6	53.2	50.7	49.1
56.2	—	—	—	—	—	—	—	—	59.3	56	53.5	51.1	49.4
56.4	—	—	—	—	—	—	—	—	59.7	56.4	53.9	51.4	49.8
56.6	—	—	—	—	—	—	—	—	—	56.8	54.3	51.8	50.1
56.8	—	—	—	—	—	—	—	—	—	57.2	54.7	52.2	50.5
57	—	—	—	—	—	—	—	—	—	57.6	55.1	52.5	50.8
57.2	—	—	—	—	—	—	—	—	—	58	55.5	52.9	51.2
57.4	—	—	—	—	—	—	—	—	—	58.4	55.9	53.3	51.6
57.6	—	—	—	—	—	—	—	—	—	58.9	56.3	53.7	51.9
57.8	—	—	—	—	—	—	—	—	—	59.3	56.7	54	52.3
58	—	—	—	—	—	—	—	—	—	59.7	57	54.4	52.7
58.2	—	—	—	—	—	—	—	—	—	—	57.4	54.8	53
58.4	—	—	—	—	—	—	—	—	—	—	57.8	55.2	53.4
58.6	—	—	—	—	—	—	—	—	—	—	58.2	55.6	53.8
58.8	—	—	—	—	—	—	—	—	—	—	58.6	55.9	54.1
59	—	—	—	—	—	—	—	—	—	—	59	56.3	54.5
59.2	—	—	—	—	—	—	—	—	—	—	59.4	56.7	54.9
59.4	—	—	—	—	—	—	—	—	—	—	59.8	57.1	55.2
59.6	—	—	—	—	—	—	—	—	—	—	—	57.5	55.6
59.8	—	—	—	—	—	—	—	—	—	—	—	57.9	56
60	—	—	—	—	—	—	—	—	—	—	—	58.3	56.4